AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning at **page 20, line 11**, and insert the following rewritten paragraph:

The motion state (eventually, the inertia force) of each part of the person can be known by using the acceleration of a predetermined region of the person or the leg body exercise assistive apparatus, the displacements of the joints of each leg of the person, and the person-side rigid link model, thereby allowing an estimation of the floor reaction forces acting on the person by his or her own weight and the application point thereof by a dynamic or geometric calculation. Similarly, by using the acceleration of a predetermined region of the person or the leg body exercise assistive apparatus, the displacements of the joints of each leg of the person, and the ~~person-side~~apparatus-side rigid link model, it is possible to estimate the floor reaction forces acting on the leg body exercise assistive apparatus by its own weight and the application point thereof. As mentioned above, the leg body exercise assistive apparatus can be downsized by reducing the sensors or the like to be attached to the person by using the acceleration or the like in the predetermined region to estimate the floor reaction forces and the application point thereof. Moreover, in this case, the acceleration sensor necessary for grasping the acceleration is only required to be attached to the region corresponding to a rigid element of either the person-side rigid link model or the apparatus-side rigid link model, thus providing a high degree of freedom in the place where it is attached. Thereby, it is possible to prevent an attachment of a sensor in a place interfering

with the leg motion of the person as much as possible.

Please replace the paragraph beginning at **page 24, line 5**, and insert the following rewritten paragraph:

An embodiment (a first embodiment) of the present invention will be described below by using Fig. 1 to Fig. 19. This embodiment is intended for the first and second features of the present invention. Fig. 1 shows a state where a person A is wearing a leg body exercise assistive apparatus 1 according to this embodiment, by means of a lateral view. Fig. 2 shows a lower part of the body of the person A wearing the leg body exercise assistive apparatus 1, by means of a front view. In Fig. 2, the hip joint, the knee joint, and the ankle joint of each leg of the person A are illustrated in ~~chain double-dashed~~ chain-and-dash line circles, respectively, for purposes of the description.

Please replace the paragraph beginning at **page 33, line 8**, and insert the following rewritten paragraph:

As shown in Fig. 4, the rigid link model S1 of the person A is represented as a link body formed of nine rigid elements and eight joint elements in this embodiment. In Fig. 4, each rigid element is represented by a line segment and each joint element is represented by a circle (except one indicated by the reference character J4). More specifically, the rigid link model S1 is roughly composed of a pair of leg sections S2, S2 corresponding to the legs of the person and an upper body section

S3 corresponding to the upper part of the body (the upper part from the waist) of the person. The upper body section S3 is configured as a link body wherein a rigid element S4 corresponding to the waist of the person is coupled to a rigid element S5 corresponding to the abdomen via a joint element JU1 and further the rigid element S5 is coupled to a rigid element S6 corresponding to the chest via a joint element JU2. Hereinafter, the rigid elements S4 to S6 are respectively referred to as the waist element S4, the abdomen element S5, and the ~~waist~~ chest element S6 in some cases, and the joint elements JU1 and JU2 are respectively referred to as the lower joint of the upper body JU1 and the upper joint of the upper body JU2 in some cases.

Please replace the paragraph beginning at **page 34, line 21**, and insert the following rewritten paragraph:

Each leg section S2 of the rigid link model S1 is configured as a link body wherein a thigh element S7 as a rigid element corresponding to the thigh of the person is coupled to the waist element S4 via the hip joint J1, a crus element S8 as a rigid element corresponding to the crus is coupled via a joint element J2 corresponding to the knee joint, and a foot element S9 as a rigid element corresponding to the foot is coupled via a joint element J3 corresponding to the ankle joint. Hereinafter, the rigid elements S7 to S9 are simply referred to as the thigh element ~~SS7~~S7, the crus element S8, and the foot element S9 and the joint elements J2, J3 are simply referred to as the knee joint J2 and the ankle joint J3, respectively, in some cases.

Please replace the paragraph beginning at **page 59, line 15**, and insert the following rewritten paragraph:

Specifically, as shown in Fig. 9, supposing that the detected rotation angles of the hip joint, the knee joint, and the ankle joint (the rotation angles around the axis perpendicular to the leg plane PL (= the XZ plane of the leg coordinate LC) from the reference posture condition) are θ_hip, θ_knee, and θ_ankle, the θ_thigh, θ_crus, and θ_foot are calculated in order by the following formulas (1a) to (1c), respectively:

$$\theta\_thigh = -\theta\_hip \tag{1a}$$

$$\theta\_crus = \theta\_thigh + \theta\_knee \tag{1b}$$

$$\theta\_foot = \theta\_crus - \theta\_ankle + 90° \tag{1c}$$

where θ_hip>0, θ_knee>0, and θ_ankle>0, while θ_thigh<0, θ_crus>0~~θ_crusθ>θ~~, and θ_foot<0. In addition, the calculations of θ_thigh, θ_crus, and θ_foot are performed for each of the leg sections individually.

Please replace the paragraph beginning at **page 77, line 5**, and insert the following rewritten paragraph:

In the above, U(G_entire/BC)" is a second derivative of the position vector in the body coordinate system BC of the entire center of gravity G_entire and is calculated from the time series data of the position vector U(G_entire/BC) of the entire center of gravity G_entire calculated by the entire center-of-gravity location calculation means 56 in each arithmetic processing period of the arithmetic

processing unit 23. The U(G_entire/BC)" denotes a relative acceleration of the entire center of gravity G_entire to the origin of the body coordinate system BC. Furthermore, the "entire weight" in the formula (13) is the entire weight of the person A (the entire weight of the person rigid link model S1) in the state where the person A is not wearing the assistive apparatus 1. Moreover, ACC(BCO/BC) is an acceleration vector of the origin BCO of the body coordinate system BC calculated by the body coordinate system acceleration and angular velocity calculation means 54. The acceleration vector ACC(BCO/BC) plus U(G_entire/BC)" denotes an actual acceleration of the entire center of gravity G_entire. Therefore, the floor reaction force vector Frf(right leg/BC) is calculated by the formula (13) from the time series data of the position vector of the G_entire calculated by the entire center-of-gravity location calculation means 56, the acceleration vector ACC(BCO/BC) of the origin of the body coordinate system BC calculated by the body coordinate system acceleration and angular velocity calculation means 54, and the entire weight of the person A (the entire weight of the person rigid link model S1). Also when the left leg is landing, the floor reaction force vector Frf(left leg/BC) is calculated by the calculation of the right-hand side of the formula (13) similarly in the single support state. In this case, ACC(BCO/BC) includes the inertial acceleration component caused by the gravity as described above and the floor reaction force vector Frf is represented by the body coordinate system BC. Therefore, there is no need to consider the gravitational acceleration or its direction. The floor reaction force vector Frf acting on the leg not landing is zero. While the Z axis of the body coordinate system BC is taken in the vertical direction for convenience of the illustration in Fig. 10, the formula (13) does not depend on the gradient of the body coordinate system

BC.

Please replace the paragraph beginning at **page 89, line 21**, and insert the following rewritten paragraph:

Similarly, the floor reaction force vectors Frf(right leg/right LC) and Frf(left leg/~~right~~left LC) viewed from the each leg coordinate system LC are obtained by multiplying the floor reaction force vectors Frf(right leg/BC) and Frf(left leg/BC) by the transformation tensors R(BC→right LC) and R(BC→left LC), respectively, as shown by the following formulas (20c) and (20d):

Frf(right leg/right LC) = R(BC→right LC)

× Frf(right leg/BC) (20c)

Frf(left leg/left LC) = R(BC→left LC)

× Frf(left leg/BC) (20d)

Please replace the paragraph beginning at **page 103, line 21**, and insert the following rewritten paragraph:

Moreover, in the arithmetic processing of the two-dimensional element center-of-gravity location calculation means 61, the position vectors in the leg coordinate system LC of the support members S9a, S9b (see the above Fig. 5) of the foot element S9 are also calculated. Here, the support member S9b on the front side is referred to as the front support member and the support member ~~S9b~~ S9a on the back side is referred to as the back support member regarding the support members

~~S9b, S9c~~ S9a, S9b of the each foot element S9. Assuming that their respective position vectors (position vectors in the leg coordinate system LC) are U(front support member/LC) and U(back support member/LC), U(front support member/LC) and U(back support member/LC) are each calculated by a formula in which U(G_foot orthosis/C_foot) in the right-hand side of the above formula (27a) is replaced with U(front support member/C_foot) or U(back support member/C_foot). U(front support member/C_foot) and U(back support member/C_foot) are position vectors of the front support member S9a and the back support member S9b in the element coordinate system C_foot (C9) of the each foot element S9 and are previously stored in the memory of the arithmetic processing unit 23.

Please replace the paragraph beginning at **page 120, line 7**, and insert the following rewritten paragraph:

In this embodiment, we can obtain the position vector U(left ~~COP orthosis~~orthosis COP/IC) of the floor reaction force application point of the floor reaction force vector Frf acting on the left leg section when the left leg is landing, as described hereinabove. The same applies to the right leg section when it is landing. In this instance, in the double support state, the position vector of the floor reaction force application point is found as described above for each of the both legs.

Please replace the paragraph beginning at **page 120, line 16**, and insert the following rewritten paragraph:

In this embodiment, the predetermined value H0 for use in finding the Z-axis component of the position vector U(~~COP orthosis~~orthosis COP/IC) of the floor reaction force application point has been defined as a constant value. If, however, the landing sensors 32 and 33 detect that the foot S9 is in contact with the ground only in the toe-side portion, you may use the difference in the Z-axis component (U(J_ankle/IC)z – U(front support member/IC)z) between the position vectors U(J_ankle/IC) and U(front support member/IC) of the ankle joint J3 and the front support member S9a, namely, the distance in the vertical direction between the ankle joint J3 and the front support member S9a, instead of the predetermined value H0, regarding the landing foot S9. This improves the accuracy of U(~~COP orthosis~~orthosis COP/IC).

Please replace the paragraph beginning at **page 121, line 4**, and insert the following rewritten paragraph:

In the arithmetic processing of the floor reaction force application point estimation means 65, finally the value U(orthosis COP~~COP orthosis~~/BC) in the body coordinate system BC of the position vector of the floor reaction force application point related to the assistive apparatus 1 is found by multiplying the position vector U(orthosis COP~~COP orthosis~~/IC) of the floor reaction force application point obtained for each landing leg section as described above by the transformation tensor R(IC→BC).

Please replace the paragraph beginning at **page 121, line 27**, and insert the

following rewritten paragraph:

More specifically, the floor reaction force vectors Frf(right leg orthosis/right LC) and Frf(left leg orthosis/~~right~~left LC) viewed from the each leg coordinate system LC are obtained by multiplying the floor reaction force vectors Frf(right leg/BC) and Frf(left leg/BC) by the transformation tensor R(BC→right LC) and R(BC→left LC), respectively, as shown by the following formulas (36a) and (36b):

Frf(right leg orthosis/right LC) = R(BC→right LC)

× Frf(right leg orthosis/BC) (36a)

Frf(left leg orthosis/left LC) = R(BC→left LC)

× Frf(left leg orthosis/BC) (36b)

Please replace the paragraph beginning at **page 122, line 12**, and insert the following rewritten paragraph:

Moreover, the position vector U(orthosis COP/LC) of the floor reaction force application point COP viewed from the leg coordinate system LC corresponding to the landing leg section S2 is obtained by multiplying the position vector U(COP/BC) of the floor reaction force application point COP of the landing leg section S2 by the transformation tensor R(BC→LC) corresponding to the landing leg section S2 as shown by the following formula (36c):

U(orthosis COP/LC) = R(BC→LC) × U(orthosis COP~~COP orthosis~~/BC) (36c)

Please replace the paragraph beginning at **page 123, line 10**, and insert the following rewritten paragraph:

In the following description of the joint moment calculation means 67, it is assumed that the acceleration vector ACC(BCO/LC), the floor reaction force vectors Frf(right leg orthosis/right LC) and Frf(left leg orthosis/left LC), and the position vector U(orthosis COP~~COP orthosis~~/LC) of the floor reaction force application point denote two-dimensional vectors each made of the pair of the X-axis component and the Z-axis component. The value on the leg plane PL of the angular velocity ω is represented by ω(BCO/LC)y.

Please replace the paragraph beginning at **page 128, line 10**, and insert the following rewritten paragraph:

In the arithmetic processing of the joint moment calculation means 67, the joint moments M(P_foot orthosis), M(P_crus orthosis), and M(P_thigh orthosis) around the axis perpendicular to the leg plane PL of the joint regions 4, 6, and 10 of the assistive apparatus 1 are calculated in order from the side of the ankle joint region 4 (J3) as described above. These joint moments M(P_foot orthosis), M(P_crus orthosis), and M(P_thigh orthosis) are such moments that should be generated in the ankle joint region 4, the knee joint region 6, and the hip joint region 10 of each leg section of the assistive apparatus 1 when supposing that the assistive apparatus 1 is performing substantially the same motion as one actually being performed by the person A wearing the assistive apparatus 1 independently (by

itself).

Please replace the paragraph beginning at **page 133, line 27**, and insert the following rewritten paragraph:

Furthermore, referring to Fig. 24, there is shown a graph showing hourly variation of a pull-up force when the leg section of the assistive apparatus is pulled up from substantially the vertical position to the horizontal position and then returned to the vertical position again with an elevator arm, which is not shown, being latched on the assistive apparatus in the independent state (in the state where it is not attached to the person). The solid line in the graph indicates an example in which the joint moments are calculated and the electric motors 18, 19 are controlled for the assistive apparatus according to the second embodiment, and the ~~bar in the graph indicated by a~~ dashed line <u>in the graph</u> indicates a comparative example in which the torque generation in the electric motors 18, 19 is not performed for the assistive apparatus according to the second embodiment.